
Roots and prosody: The Iraqi Arabic derivational verb

Matthew A. Tucker



Electronic version

URL: <http://journals.openedition.org/rlv/1833>
DOI: 10.4000/rlv.1833
ISSN: 1958-9239

Publisher

Presses universitaires de Vincennes

Printed version

Date of publication: 1 December 2010
Number of pages: 31-68
ISBN: 978-2-84292-264-1
ISSN: 0986-6124

Electronic reference

Matthew A. Tucker, « Roots and prosody: The Iraqi Arabic derivational verb », *Recherches linguistiques de Vincennes* [Online], 39 | 2010, Online since 01 December 2014, connection on 30 April 2019. URL : <http://journals.openedition.org/rlv/1833> ; DOI : 10.4000/rlv.1833

Matthew A. TUCKER

University of California, Santa Cruz

**ROOTS AND PROSODY:
THE IRAQI ARABIC DERIVATIONAL VERB**

ABSTRACT

A number of recent Optimality-Theoretic approaches to Nonconcatenative Templatic Morphologies (NTM) such as the verbal systems of Arabic and Hebrew have argued that NTMs do not require reification of the consonantal root (Bat-El, 1994; Ussishkin, 1999, 2000, 2005; Buckley, 2003). This article presents an approach to deriving NTMs which countenances both the morphemic status of the consonantal root and the emergent nature of the prosodic template. Based upon work in Kramer (2007) this “root-and-prosody” model claims that root-and-pattern behavior arises from the necessary satisfaction of prosodic markedness constraints at the expense of the faithfulness constraints CONTIGUITY and INTEGRITY. Additionally, this article shows that a solution exists to the problem of NTM languages within Generalized Template Theory (McCarthy & Prince, 1995) which does not need Output-Output Correspondence. In doing so, this work also argues for the extension of indexed markedness constraint (Pater, to appear) to prosodic alternations. Prosodic augmentation is shown to follow from particular rankings of such indexed prosodic markedness constraints, eliminating the need for prosodic material in the input.

KEYWORDS

Morphophonology, templatic morphology, root-and-pattern morphology, consonantal root, Arabic.

The Semitic languages have been the object of study for morphologists, syntacticians, and phonologists almost since the advent of generative grammar as a field (see, for instance Chomsky, 1955; McCarthy, 1979, 1981; and Ussishkin, 2000; to name just a few).¹ This is because such languages are prototypical of the class of word-formation strategies known as NONCONCATENATIVE TEMPLATIC MORPHOLOGY (NTM) (McCarthy, 1981). Descriptively, these languages form words by interleaving various vocalic and consonantal affixes around a two-, three-, or four-consonantal root, as Table 1 demonstrates for the dummy root *ʔʔl*, roughly meaning ‘doing, action’ in Iraqi Arabic, with each form assigned its number according to the Western grammatical tradition for Arabic.²

Number	Verb	Template
I	ʔaʔal	C ₁ VC ₂ VC ₃
II	ʔaʔʔal	C ₁ VC ₂ C ₂ VC ₃
III	ʔaaʔal	C ₁ VVC ₂ VC ₃
V	tʔaʔʔal	tC ₁ VC ₂ C ₂ VC ₃
VI	tʔaaʔal	tC ₁ VVC ₂ VC ₃
VII ³	nʔaʔal	nC ₁ VC ₂ VC ₃
VIII	ʔtaʔal	C ₁ tVC ₂ VC ₃
X	ʔtaʔʔal	ʔtaC ₁ C ₂ VC ₃

Table 1: *ʔʔl*, ‘doing, action’

1. This paper owes many people thanks: Scott AnderBois, Michael Becker, Ryan Bennett, Robert Henderson, Junko Itô, Ruth Kramer, Armin Mester, Jeremy O’Brien, Jaye Padgett, Tomas Riad, David Teeple, Adam Ussishkin, Michael Wagner, Munther Younes, Draga Zec, and Kie Zuraw have all provided helpful comments or discussion. We would also like to thank audiences at the 2009 Research Seminar at the University of California, Santa Cruz, the 2009 Linguistics at Santa Cruz Conference, the Morphology Reading Group at UCSC, and the 28th West Coast Conference on Formal Linguistics for perceptive and enlightening discussion. Finally, thank you to two anonymous reviewers for numerous detailed and insightful comments. Despite all this assistance, any errors which remain are the responsibility of the author.

2. Thus we do not use the term employed by many Arabists for these patterns – BINYANIM (see, for instance, McCarthy, 1981). There is no theoretical claim meant by this choice. Also, note that Iraqi Arabic lacks a form IV, unlike many other dialects of Arabic (see Erwin, 2004). Additionally, while a form numbered IX does exist in Iraqi, it is unproductive and demonstrably denominal. Thus, we do not treat form IX in this work.

3. In other studies on (Iraqi) Arabic, these forms are usually glossed with a prothetic /ʔ/-. We abstract away from this prothesis here, since it does not occur in all phonological environments (see McCarthy, 1993; Ussishkin, 2000 for explicit discussion of this prothetic material).

Thus one can see in such examples that derivational verbal morphology in Arabic can be as simple as the insertion of two vowels into the consonantal root (forms I, III), the augmentation of segmental material (forms II and III), or the addition of consonantal affixal material in addition to vowels (forms V, VI, VII, VIII, X). However, each of the forms faithfully preserves the triconsonantal root *ʔl* in the output string.

Such blatantly nonconcatenative morphological behavior stands in stark contrast to the better-studied morphologies of other languages which form derived forms by simple affixation, characterizeable in terms of linear concatenation statements. Moreover, it has been known since the earliest generative works on Arabic and Hebrew (McCarthy, 1979, 1981) that NTM languages also show a strong influence of word-level prosody on morphology. This can be seen easily in Table 1, where no output form is larger than two syllables. Though it must be the goal of any analysis which desires explanatory adequacy to relate these two facts, it is not as immediately clear what the axiomatic units of morphology should be in such an approach, or what the relationship needs to be between the input and realization of prosody.

While the above characterization of the Arabic derivational verbal paradigm is the one used by the classical and modern Arab grammarians, it is not immediately obvious that such an analysis should be the one adopted in generative approaches to Arabic morphophonology. Historically, however, this was the approach adopted in the seminal works of McCarthy (1979, 1981, 1985), which described the Arabic morphology discussed here in terms of the association of the root and vowel morphemes to an autosegmental CV-tier (Goldsmith, 1976). In this framework, vowels, the root, and affixes each comprised different morphemes *sui generis*, whose association to one another and concatenation were governed by the familiar constraints on autosegmental representations.

The advent of the framework of PROSODIC MORPHOLOGY (McCarthy & Prince, 1993a) changed this view, arguing instead that the CV-tier lacked explanatory force, since templates were simply stipulated in the lexicon as particular CV-sequences. Prosodic Morphology aimed to show that all templates in natural language were “comprised of the authentic units of prosody.” By this it was meant that lexicons were allowed to list templates, but that those templates must be well-defined prosodic units, consisting of either morae, syllables, feet, or prosodic words.⁴ This approach, however, faced much the same problem as its predecessor; questions lingered concerning the explanatory force of the template inventory.

4. We use the following abbreviations in this work for the prosodic constituents relevant to word-formation: μ = mora, σ = syllable, F = foot, ω /PRWD = prosodic word.

Following the introduction of OPTIMALITY THEORY (OT; Prince & Smolensky, 1993/2004) into generative phonology, a new approach to nonconcatenative and templatic morphology known as GENERALIZED TEMPLATE THEORY (GTT; McCarthy & Prince, 1994) emerged which could treat the templatic inventory in a satisfactory way. This tradition argued that explanatory power could be extended in analyses of nonconcatenative templatic languages by deriving the templates, not simply from a stated inventory of prosodic units and the lexicon, but from the interaction of independently motivated constraints on the well-formedness of prosodic output. Thus, constraints dictating minimal and maximal prosodic words, for instance, were used to derive the morphology of languages (*e.g.*, Hebrew, Ussishkin, 2000; Ussishkin, 2005) where bisyllabic prosodic words formed the optimal output.

In this GTT framework several analyses have emerged which argue against the existence of the consonantal root, or at least its usefulness to prosodic and phonological theory, which we will refer to as the class of FIXED PROSODY approaches. Building on work on Hebrew by Bat-El (1994, 2002, 2003) and Ussishkin (1999, 2000, 2005), these approaches argue that derivational morphology in Hebrew and Arabic does not require access to the consonantal root (*pace* early generative accounts) as a morpheme. Instead, the consonantal root became seen as the “residue” left over after prosodic constraints forced affixal material to overwrite vowels.

This GTT approach to Semitic morphophonology has not been free of worries; however, as recent work (Arad, 2003, 2005; Nevins, 2005) has argued that the GTT approach misses generalizations in certain cases, as well as makes erroneous predictions in others. Thus, the question of the proper characterization of Semitic verbal morphology is still very much an open one.

This work suggests a new model which can account for both of these theoretical and empirical needs, especially within the domain of words formed from abstract roots. Taking up the proposal of Kramer (2007) for Coptic, this approach is called the ROOT AND PROSODY (RP, henceforth) model, and its major claims are twofold:

- (1) Central Claims of the Root-and-Prosody Approach:
 - (A) ROOTS AND VOWELS ARE MORPHEMES: the input to NTM forms consists of the consonantal root and a vowel affix (*e.g.*, /a/ for perfective aspect).
 - (B) TEMPLATES ARE GIVEN BY PROSODY: Templates are emergent properties of words in NTM languages which surface from the necessary satisfaction of high-ranking prosodic markedness constraints (an extreme version of “templates are made up of the authentic units of prosody,” from McCarthy & Prince, 1993a: 1).

This approach thus borrows from GTT and Fixed Prosody (FP, henceforth) the claim that templates are not axiomatic morphological entities, but rather

should be derived from the interaction of prosodic well-formedness constraints with segmental faithfulness considerations. As such, templates are better understood in this approach as emergent properties of prosody. It does admit the consonantal root, however, and thus locates the difference between NTM and more concatenative morphologies purely in the lexicon and ranking in CON – the constraint inventory of the language. In an Optimality-Theoretic grammar, CON is the universal inventory of constraints, and variation is assumed to occur solely as a result of differential ranking of constraints. Languages with NTM are thus special only insofar as they contain a larger concentration of discontinuous morphemes in their lexicons and rank highly their prosodic markedness constraints.

The admission of the consonantal root into morphophonological analysis, in addition to providing a means to empirical coverage of the derivational verbal system outlined in Table 1, also allows for some insight into a particularly recalcitrant problem in the study of Arabic. As discussed by McCarthy (1979, 1981), Arabic's form VIII/*ftaʕal* pattern shows the effect of phonological processes which only occur in this form. This work shows that such processes are understood in the RP approach – a difficult task in theories which do not admit the special status of root consonants over and above other consonants in the language at large, such as the FP approach.

This paper is organized as follows: in section 1 we discuss the word-level prosodic facts in Iraqi Arabic, the regional dialect which forms the empirical case study for NTM behavior in this work. Iraqi Arabic is chosen because of its relative underrepresentation among spoken Arabic dialects in generative linguistic work, and this work thus attempts to fill (in part) this lacuna in the generative work on regional dialects of Arabic. Section 2 analyses the verbal system of Iraqi Arabic in terms of the prosodic generalizations introduced in section 1 and shows that they are sufficient for deriving NTM behavior from constraint interaction, provided that the consonantal root has morphemic status. Finally, section 3 discusses some implications and concludes the work.

1. Iraqi Arabic prosody

Iraqi Arabic, the dialect spoken by the educated class in Baghdad, is typical of Arabic dialects in showing an inexorable intertwining of prosody and word formation. This section presents the basic facts from Iraqi Arabic word-level prosody in two parts. Section 1.1 presents data from stress placement to argue for the importance of the moraic trochee in Iraqi Arabic and proposes a specific OT account of these facts. Section 1.2 discusses and similarly analyzes facts concerning word-level prosodic structure.

1.1. Feet and Stress

Iraqi Arabic words have a single main stress per word, which can fall on the ultima (2), penult (3), or antepenult (4), data for all of which comes from Erwin (2004):

- (2) Stress on the ultima:
 - (a) /ʃa'foo/, 'they saw him'
 - (b) /t'aʕ'baan/, 'tired'
- (3) Stress on the penult:
 - (a) /'naadi/, 'club'
 - (b) /'badla/, 'suit'
 - (c) /'nisa/, 'he forgot'
- (4) Stress on the antepenult:
 - (a) /'ʕaalami/, 'world'
 - (b) /'madrasa/, 'school'
 - (c) /'ʃarika/, 'company'

Such facts lend themselves to the following generalizations:

- (5) Stress generalizations in Iraqi Arabic:
 - (a) Stress the ultima if:
 - (i) it is superheavy (2b)
 - (ii) it is heavy and vowel-final (2a)
 - (b) Otherwise, stress the penult if:
 - (a) it is heavy (3a)
 - (b) the word is two light syllables long (3c)
 - (c) Otherwise, stress the antepenult if:
 - (a) it is heavy (4a-b)
 - (b) the word ends in three light syllables (4c).

From (5), the structure of feet in Iraqi Arabic will be familiar as an example of a quantitative stress system which builds moraic trochees from right to left with final consonant extrametricality. Furthermore, (5) also makes it clear that the prosodic word is right-headed in IA. There are numerous ways to account for such systems in the framework of Optimality Theory, but following Sherer (1994) and Rosenthal & van der Hulst (1999), I propose the following inventory of constraints for IA:

- (6) NONFINALITY:
The head of a Prosodic Word is not final in ω .⁵

5. As will be demonstrated in section 2.1.2, this constraint must be relativized to particular morphemic input (Pater, 2000, *et seq.*) as well as different levels of the prosodic hierarchy. However, for the present purposes, staying with the general version of NONFIN

- (7) W(EIGHT-TO-)S(TRESS)-P(RINCIPLE):
Heavy syllables are stressed.
- (8) ALIGN(F_{hd} , R, ω , R) (RIGHTMOST):
Align the head foot to the right edge of some prosodic word.
- (9) *APP(END-to- σ):
Coda consonants are not adjoined directly to the syllable node.
- (10) * μ /C:
Consonants are not moraic.

The constraints *APPEND and * μ /C together are used to ensure positional variability in the weight of coda consonants, following Sherer (1994). The ranking *APPEND >> * μ /C ensures that coda consonants are moraic generally, as shown in Tableau 1 (cf. Rosenthal & van der Hulst, 1999: 34).⁶

/d ^ʕ arabna/	*APPEND	* μ /C
☞ a. d ^ʕ a(ʔ ^{ra} b)na		*
b. (ʔ ^{ra} d ^ʕ)na	*!	

Tableau 1: *APPEND >> * μ /C

As for the placement of the head foot, in odd-parity sequences consisting of all light syllables, stress falls on the first syllable, in violation of RIGHTMOST. This means that NONFINALITY must dominate RIGHTMOST, as Tableau 2 shows (cf. Rosenthal & van der Hulst, 1999: 35).

/ʃarika/	NONFIN	RIGHTMOST
☞ a. (ʔ ^ʃ a ^{ri})ka		*
b. ʃa(ʔ ^{ri} ka)	*!	

Tableau 2: NONFIN >> RIGHTMOST

Furthermore, WSP, the constraint which demands that heavy syllables be stressed must dominate NONFIN, as Tableau 3 shows.

helps with simplifying exposition. Since the rest of the stress constraints do not interact with the morphological constraints introduced later, it can be assumed that all commentary in this section is intended to be read for the *general* version of NONFIN, and not the relativized version introduced below.

6. In here and what follows, we use (parentheses) to denote foot boundaries and [brackets] to denote prosodic word boundaries, where relevant. **Bold typeface** is used to indicate consonant weight where the moraic status of consonants is crucial.

/ʕalee/	WSP	NONFIN	RIGHTMOST
a. ʕa(ʕlee)		*	
b. (ʕa)(lee)	*!		*

Tableau 3: WSP >> NONFIN

Turning now to words containing more than one CVC sequence such as *?ahlan*, “hello,” the existence of penultimate stress shows that Iraqi Arabic allows for parses which treat word-final consonants as nonmoraic, in violation of *APPEND. Tableau 4 shows that this can be accommodated by ranking NONFIN >> APPEND (cf. Rosenthal & van der Hulst, 1999: 36). This is the core of the “weight-by-position-by-position” argument advanced in that work).⁷

/ʔahlan/	WSP	NONFIN	*APPEND	*μ/C
a. (ʔah)lan			*	*
b. (ʔah)(lan)	*!	*		**
c. (ʔah)(ʕlan)	*!	*		**
d. (ʔahlan)		*!	**	
e. (ʔah)lan	*!			**

Tableau 4: NONFIN >> *APPEND

The ranking NONFIN >> *APPEND ensures that word-final consonants will be parsed as nonmoraic when the high-ranking constraint NONFIN compels such a parse. Since this nonmoraic parsing of coda consonants can only occur to satisfy NONFIN, coda consonants are guaranteed moraic in all other positions in the language. Thus we have the final ranking for stress in IA as in (11):

- (11) Rankings for Stress in IA:
 WSP >> NONFIN >> *APPEND >> *μ/C
 NONFIN >> RIGHTMOST

This section has analyzed the word-stress system of Iraqi Arabic, an empirical first for the literature. Additionally, it has motivated the use of NONFINALITY, a constraint which section 2 will show is integral in word formation in IA. The next section turns to motivating the second of the prosodic constraints important for IA word-formation. This constraint is argued to be F(OOT)BIN(ARITY), a constraint which demands that feet (and therefore minimal prosodic words) be binary at the level of the mora.

7. We correct in this tableau two errors in the printed version of Rosenthal & van der Hulst (1999). Specifically, candidates (b) and (c) in Rosenthal & van der Hulst’s (1999) (36) do not have WSP violations. These violations are required, however, by the interpretation of WSP used in (7). These changes do not change the empirical predictions in that work, however.

1.2. The Prosodic Word in Iraqi Arabic

Turning to the higher prosodic level which defines the prosodic word, one can see similar constraints active on prosodic form and size as were shown to be active at the level of the foot. This section provides evidence for two constraints: one enforcing a minimality requirement and one enforcing a maximality requirement.

Let us begin with the former. The picture which emerges from examining several pieces of data is that the minimal prosodic word in IA consists of one quantitative trochee. Informally, this is as in (12):

$$(12) \quad \omega_{min} = [\mu\mu]$$

Three arguments support this conclusion, the first of which comes from the behavior of biliteral roots in surface forms in Iraqi Arabic. As with other Arabic dialects and Modern Standard Arabic (Ryding, 2005), IA instantiates a class of roots which have only two consonants as members. Given that final consonants are nonmoraic (as shown in section 1.1), such roots lend themselves to the possibility of surfacing as a degenerate foot, (CV)C. Such forms are unattested in the language at large, however. In the case of biliteral roots, this is avoided on the surface by gemination of the final consonant (*cf.* McCarthy, 1979, and the analysis of such roots as spreading of their second consonantal member). This is exemplified in (13):

- (13) Gemination of Biliteral Root-formed Verbs in IA (Erwin, 2004):

/ʔab/ → [ʔabb] (*ʔab), ‘father’

/ʔum/ → [ʔumm] (*ʔum), ‘mother’

As one can see, roots such as $\sqrt{ʔb}$ never surface as (CV)C, but rather always as (CVC)C, and always by gemination of the final radical. Additionally, if such words are augmented by suffixes which contain vowels, this gemination does not surface, as in the possessive of (13a), *ʔabuuii*, ‘my father’. If the minimal prosodic word is indeed as in (12), then this behavior is not only expected, but predicted.

Along a similar vein one can adduce a second argument for (12) by examining the behavior of prepositions in IA which are of the prosodic form CVC. As with biliteral roots, such prepositions threaten to surface as a degenerate foot, something the discussion and analysis in section 1.1 and (12) expressly forbid. In order to escape such a fate, these prepositions consistently surface in one of two ways: (1) as a CVC clitic, prosodically dependent upon a host which is not subminimal with respect to (12), or (2) as a CVCC functional element capable of standing on its own. This CVCC structure is, moreover, always achieved by geminating the final consonant, as shown in (14):

- (14) CVC Words and Their Surface Forms in IA (Erwin, 2004):

/mm/, ‘from, of’ → [mnn]/[mn-], (*mn)

/kul/, ‘all, all of’ → [kull]/[kul-], (*kul)

Again, (12) accounts for this contrast nicely, demanding that elements which intend on being freestanding prosodic words must be minimally bimoraic, as with the CVCC versions of the prepositions *mm* and *kul*. If not, then such elements must be prosodically dependent. Additionally, if one considers these facts in concert with the stress analysis laid out in the previous section, then the following generalization results: while word-final consonants are typically weightless in IA, one can “hear the mora” which would normally be attributed to these consonants when word-minimality considerations dictate.

Such contrasts between clitic and freestanding prosodic words are not confined solely to this domain, however. Turning to the class of negative particles with the prosodic structure CV, one finds identical facts, comprising the third and final argument for (12). Whereas CVV is a perfectly legitimate prosodic word (since only consonants are extrametrical in IA), CV is not, and something must be done to augment such inputs or they will necessarily fall into clitic-hood. This shows that this prediction of (12) is indeed borne out:

- (15) CV Words and Their Surface Forms in IA (Erwin, 2004):

/ma/, ‘not (verbal)’ → [maa]/[ma-], (*ma)

/la/, ‘not (verbal)’ → [laa]/[la-], (*la)

Again, this contrast is neatly understood in the context of positing a single quantitative trochee as the minimal word in IA. Moreover, the facts discussed in (13-15) are consistent with cross-dialectal work on the prosody of Arabic, as discussed in McCarthy & Prince (1990) and Watson (2002). Specifically, Watson (2002) notes that in the San’ani and Cairene dialects of Arabic, facts identical to (13-15) hold, though the degenerate-foot versions of such words also can exist as freestanding prosodic words. However, in such cases, Watson notes that these subminimal prosodic words bear no main word stress. From these facts, Watson concludes that a minimal prosodic word constraint defined as (12) is active in these dialects, as well.

Turning to the issue of maximality, one also can prove that binarity is involved, but this time at the level of the syllable. Specifically, (16) states informally that the maximal prosodic word in Arabic is bisyllabic:

- (16) $\omega_{max} = [\square\square]$

The activity can be seen in two places in IA, the first of which is the distribution of uninflected forms along the metric of syllable count. Thus, following the methodology in McCarthy & Prince (1990) for MSA nominals, one can examine the IA lexicon and find words which range from two to four morae in length, but never a word which is greater than two syllables in length:

(17) Range of Morae/Syllable Distribution in IA (Erwin, 2004):⁸

- (a) $\mu\mu$: nisa, 'he forgot'
- (b) $\mu\mu\mu$: naadi, 'club'
- (c) $\mu\mu\mu\mu$: t^ʕaʕ'baan, 'tired'

Thus, one simply never finds uninflected root-derived prosodic words in IA of the form * $[\square\square\square]$, a strong argument for the existence of (16) in the grammar of IA.

Another argument for such a constraint comes from the observed "truncation" which occurs with forms IV, *ʔaqʕal* and X, *staʕʕal*.⁹ If one were to blindly concatenate the affixes in Ussishkin (2000), one would expect the ungrammatical forms instead of the actual forms in (18-19):

(18) Form IV "Truncation":

- (a) Expected: *ʔaCVCVC; Actual: ʔaCCVC
- (b) Example: ʔaʕlan, 'to announce' (*ʔaʕalan; Erwin, 2004)

(19) Form X "Truncation":

- (a) Expected: *staCVCVC; Actual: staCCVC
- (b) Example: staʔnaf, 'to appeal (a case)' (*staʔanaf; Erwin, 2004)

Since the forms which would violate (16) are not attested, one can safely assume the activity of such a constraint in IA. Assuming this is also in accord with previous work on the nominal system of MSA done in McCarthy & Prince (1990). In a careful study of the distribution of prosodic forms across the MSA nominal system, McCarthy & Prince (1990) find that no root-derived noun exists in the singular which violates (16).

With the constraints (12) and (16) firmly established for IA, the question immediately arises as to how to express such restrictions in an Optimality-Theoretic grammar. Taking first the issue of minimality, the constraint in (20) accounts for such facts, assuming that the smallest foot in a language also forms the minimal prosodic word:

8. This claim must be qualified, since such words do exist in IA, such as *madrasa*, 'school' or *stalanna*, 'we received.' Such forms either: (i) are word-derived by the criteria in Arad (2005), such as the deverbal noun *madrasa*, or (ii) bear inflectional morphology. Future research will be needed for (ii), at least, and see the Fixed-Prosodic literature (Ussishkin, 2000; Ussishkin, 2005) for explanations of (i).

9. This phenomenon is termed "truncation" because, as section 2.1.3 argues, it is not actually truncation but rather an alternative linearization of the first affixal vowel. This distinction matters not for the point here concerning maximal prosodic words, and thus we follow Ussishkin (2000) in calling such facts "truncation" for the sake of discussion.

- (20) $F(oo)tBIN(ARITY)$:
 Feet are binary at the level of the mora.¹⁰

Because each prosodic word must contain at least one foot, $FtBIN$ necessarily ensures that such prosodic words will be minimally quantitative trochees, exactly as (12) mandates.

As far as the issue of maximality is concerned, the empirical conclusions reached in the previous section accord with much literature concerning the bisyllabic maximality of stems (for a direct application to Semitic morphophonology, see Ussishkin, 2005). In order to capture this generalization, one can, as Ussishkin (2005) does, extend the framework of Hierarchical Alignment (Itô *et al.*, 1996). This framework uses the $ALIGN$ family of constraints to relate prosodic categories to one another, and as Itô *et al.* (1996), Ussishkin (2000), and Ussishkin (2005) discuss, these constraints can be used to derive size effects. What is relevant for the present context is the constraint σ - $ALIGN$, given in (21):

- (21) $SYLLABLE-PrWdALIGNMENT$ (σ - $ALIGN$; Ussishkin, 2005):
 $\forall F \exists \omega [\omega \supset F \wedge ALIGN(F, \omega)]$,
 (\equiv Every syllable must be aligned to the edge of some prosodic word containing it.)

In actual analysis, this constraint will penalize any output which contains a syllable not at one edge or the other of a prosodic word, effectively limiting prosodic words to two syllables unless some higher-ranked constraint mediates against this effect. Since this work is concerned only with stems in IA, such a situation never will arise, and stems are limited to two syllables, capturing the maximality effect examined in this section.¹¹ Since this maximality effect is respected by all the verbal forms discussed below, σ - $ALIGN$ will not be shown in subsequent tableaux, but it must be understood to be active in IA.

10. Ussishkin (2000) separates this constraint into two constituent parts, one enforcing foot minimality and the other enforcing foot maximality. We have no empirical or theoretical considerations for not following this move, but rather only expository ones. This constraint plays a different role in the RP approach than it does in the FP approach, and the difference in role mitigates against the need for decomposing this constraint. Thus, it should be inconsequential to the RP approach whether or not $FtBIN$ is a unitary or composite constraint, and for simplicity we leave it as a single constraint.

11. Additionally, if one ranks σ - $ALIGN \gg M$ - $PARSE$ (Prince and Smolensky, 1993/2004), this will ensure that no output surfaces (for stems) which violates maximality. This ranking then prevents the creation of stems which have more than four consonants, since any root of five (or more) consonants would require a third syllable to create a well-formed output. This, in turn, can be used to capture the observation that no five-consonant roots exist in native IA words (Erwin, 2004).

With a clear picture of the foot and word-level prosody in IA in hand, it is now possible to turn to outlining the RP approach, which draws heavily upon the constraints proposed in this section.

2. The Root-and-Prosody approach

This section proposes an approach to the morphology and prosody of root-derived words in NTM languages, called the ROOT-AND-PROSODY (RP) approach. This approach is couched within the tenets of Generalized Template Theory (McCarthy & Prince, 1995), and makes two substantial theoretical claims:

- (22) Central Claims of the Root-and-Prosody Approach:
- (a) ROOTS AND VOWELS ARE MORPHEMES: the input to NTM forms consists of the consonantal root and a vowel affix (*e.g.*, /a/ for perfective aspect).
 - (b) TEMPLATES ARE GIVEN BY PROSODY: Templates are emergent properties of words in NTM languages which surface from the necessary satisfaction of high-ranking prosodic markedness constraints (an extreme version of “templates are made up of the authentic units of prosody” (McCarthy & Prince, 1993a: 1)).

The Root-and-Prosody approach borrows heavily from the Generalized Template Theory (GTT; McCarthy & Prince, 1995, *et seq.*) the claim that templatic effects in natural language are not the result of lexical specification of templatic morphemes. Instead, this literature argues that templatic patterns in word formation result from the satisfaction of high-ranking markedness constraints on prosodic output form. Thus, where McCarthy (1981) gives templatic effects in Arabic as the result of melodic association to a morphemic CV-tier, GTT would hold that these templates are the result of satisfaction of high-ranking constraints on prosodic-word level structure. This is exactly the connection made in the Fixed Prosodic literature on NTM languages (Ussishkin, 2000; Buckley, 2003; Ussishkin, 2005), where it is argued that templatic form is represented in Semitic in exactly this way. Thus, the RP approach shares with these works the assumption in (22b).

What is different about the RP approach is assumption (22a). In the RP approach, the input to any particular derived verb in an NTM language consists of the consonantal root, a set of vocalic affixes, and any prefixal or suffixal material. Positing a root *qua* morpheme not only allows for derivation of root-specific morphological processes, but also avoids the worry noted by Marantz (1997) that word-based approaches will be forced to posit output-output faithfulness to base forms which are not independently attested in the language at large.

Assuming the theoretical backdrop of GTT also allows the RP approach to relate (22a) and (22b) to output forms. Another way of stating the aims of GTT is to say that where faithfulness constraints do not dictate otherwise, default word-level prosodic form will result. The RP approach extends this notion to argue that root/affixal material is discontinuous in the output because of the low-ranking of the faithfulness constraint CONTIGUITY:¹²

- (23) CONTIG(UNITY) (McCarthy & Prince, 1995):

The portion of the input and output strings standing in correspondence forms a continuous string.

Thus, the informal idea of the RP approach is that NTM effects in languages result because there is no other optimal way to linearize input root/affixal material under the auspices of high-ranking prosodic constraints. Output forms which insert segments between, for instance, members of the consonantal root, therefore do not incur fatal faithfulness violations (ensured by the low-ranking CONTIGUITY in such languages), and are actually optimal from the perspective of highly-valued prosody. In such an approach, templates become an emergent property of NTM languages, residual generalizations in form which arise because the language's prosodic constraints leave no other linearization of affixal and root material available.

In a substantive way, the RP approach can be seen as the “null hypothesis” for NTM languages from the point of view of GTT. Specifically, the RP approach requires the existence of only three major classes of constraints, each of which have been shown to be independently needed, even for languages which do not display NTM behavior:

- (24) Constraints in an RP Approach:

- (a) PROSODIC CONSTRAINTS: Constraints on prosody independently needed in the language (FtBIN, WSP, NONFINALITY, etc.).
- (b) MORPHOLOGICAL CONSTRAINTS: Constraints which align morphemes in linear prosodic structure (ALIGN-L(*n*, ω), ALIGN-L(-*t*-, ω), etc.).
- (c) FAITHFULNESS CONSTRAINTS: Correspondence-Theoretic faithfulness constraints of the usual families (DEP-ROOT, MAX, CONTIGUITY, etc.).

Constraints of the kind in (24a) were motivated in section 1, and thus are needed for any analysis of Arabic, independent of the RP approach. Similar considerations are true for the alignment constraints in (24b). Since, empirically, such affixal material always occurs toward the left edge of the

12. The original formulation of this constraint in McCarthy and Prince (1995) divides CONTIGUITY into two constraints I-CONTIGUITY (“no skipping”) and O-CONTIGUITY (“no intrusion”). Since the distinction between these two kinds of discontinuities is irrelevant for our purposes, we conflate them into one constraint here. Nothing crucial hinges upon this move.

prosodic word, any approach within GTT to Arabic will necessarily include such constraints, and such constraints are a necessary assumption in any work which uses GENERALIZED ALIGNMENT (McCarthy & Prince, 1993) to do morpheme placement. Finally, the faithfulness constraints in (24c) are the industry standard Correspondence-Theoretic faithfulness constraints (McCarthy & Prince, 1995). Thus, the RP approach does not need to appeal to extra considerations such as the OO-FAITH family of constraints (Benua, 2000) and is desirable for deriving root-derived words from a parsimony point of view.

Since a complete analysis of all the nonconcatenative templatic behavior in even one dialect of Arabic would require, at the very least, a monograph-sized work, this paper concerns itself in the next section with deriving a small corner of the Iraqi Arabic verbal system, namely the verbal stems. The analysis below deals with capturing the arrangement of affixes and roots in linear/prosodic structure to the absence of inflectional morphology. In order to capture facts concerning inflection, one could pair the discussion below with the OPTIMAL PARADIGMS analysis argued for in McCarthy (2005), understanding the output of the subsequent sections as the stem-level input to Optimal Paradigms. Such an understanding accounts for the fact that, when inflectional morphology is considered, many verbal forms in IA violate the σ -ALIGN constraint used to capture stem-maximality in the previous section. Such a full integration of the RP approach with Optimal Paradigms must be, however, the topic of future work for reasons of space.

2.1. Analysis of Root-Derived verbs in Iraqi Arabic

The Iraqi Arabic derivational verbal system consists of an NTM in which a 2-4 consonantal root is nonconcatenatively affixed around one or two vowels according to fixed patterns. Table 2 gives the eight patterns which exist in IA for 2 and 3-consonantal roots. Triliteral roots are exemplified, in accordance with Arabic grammatical tradition, using the root \sqrt{fsl} meaning roughly, 'doing, action'. Biliteral roots are exemplified using the root \sqrt{mr} , meaning 'passing, crossing'.¹³

13. There is no form IV pattern in Table 2 because, while Iraqi does have some form IV verbs, they are quite rare and possibly archaic, unlike in Modern Standard Arabic (*cf.*, Erwin, 2004 for Iraqi and Ryding, 2005 for Modern Standard).

	Triliteral	Biliteral
Root	$\sqrt{f\gamma l}$	\sqrt{mr}
I	faʕal	marr
II	faʕʕal	marrar
III	faaʕal	maarar
V	tfaʕʕal	tmarrar
VI	tfaaʕal	tmaarar
VII	nfaʕal	nmarr
VIII	ftaʕal	mtarr
X	stafʕal	stamarr

Table 2: Bi- and Triliteral Roots in IA

Several generalizations are apparent in Table 2 which are relevant to the RP approach. The first of these is that, regardless of the number of root consonants, the minimal affix which can be identified as perfective aspect and active voice is /a/. One could posit a bivocalic affix /aa/, but there are two problems with such an approach. The first is that this would be a curious input from the perspective of biliteral roots, which do not show two /a/'s in the output, and furthermore show no evidence for deletion of an input vowel. The second reason to doubt such an input is that it would violate the OBLIGATORY CONTOUR PRINCIPLE. While it is not an *a priori* necessity that inputs should have to respect such a constraint, the subsequent sections will show that these forms can be analyzed without having to posit inputs which do violate it. Thus, from the perspective of theoretical parsimony, a bivocalic affix is rejected as the input to forms which show two identical vowels for the output. Given this assumption, the RP approach must treat the second vowel as an instance of fission with respect to an input /a/ (see section 2.1.1, below).

The second generalization apparent in Table 2 concerns the appearance and restriction of consonant clusters. One can see that for triliteral roots, complex margins are present only in forms which contain a segmental affix over and above the root and vowel (*i.e.*, forms V, VI, VII, VIII, and X but not I, II, or III). When viewed against the fact that these same forms (VII, VIII, and X) are monosyllabic for biliteral roots, one can extract the following generalization:

- (25) The input vowel /a/ does not fission except when a complex margin would result.

(25) is active in forms I, VII, VIII, and X in IA, as the next three examples show for the first three of these forms:¹⁴

- (26) Form I syllabicity alternations:
- (a) Biliteral Roots:
 - (i) ʒabb, 'he liked' (*ʒabbab, *ʒabab, √ʒb)
 - (ii) ʔaʃʃ, 'he cheated' (*ʔaʃʃaʃ, *ʔaʃaʃ, √ʔʃ)
 - (iii) wann, 'he moaned' (*wannan, *wanan, √wn)
 - (b) Triliteral roots:
 - (i) t^ʕubax, 'he cooked' (*t^ʕbax, *t^ʕabx, √t^ʕbx)
 - (ii) ʔaxað, 'he took' (*ʔaxað, *ʔaxð, √ʔxð)
 - (iii) kitab, 'he wrote' (*ktab, *katb, √ktb)
- (27) Form VII syllabicity alternations:
- (a) Biliteral roots:
 - (i) nʒall, 'he was solved' (*nʒalal, *ʒanlal, √ʒl)
 - (ii) nʔaʃʃ, 'he was cheated' (*nʔaʃaʃ, *ʔanʃaʃ, √ʔʃ)
 - (b) Triliteral roots:
 - (i) ndiras, 'he was studied' (√drs)
 - (ii) nkital, 'he was killed' (√ktl)
- (28) Form VIII syllabicity alternations:
- (a) Biliteral roots:
 - (i) ð^ʕð^ʕarr, 'he was compelled to' (√ð^ʕr)
 - (ii) htamm, 'he became interested' (√hm)
 - (b) Triliteral roots:
 - (i) xtilaf, 'he differed' (√xlf)
 - (ii) ʔtaqad, 'he thought/believed' (√ʔqd)

This generalization is captured in sections 2.1.1-2.1.3 with a particular ranking of the prosodic constraint NONFINALITY and the faithfulness constraint INTEGRITY, which prohibits fission. Finally, one can see that forms II/III and their passive counterparts forms V/VI show lengthening of input material. This input material is usually analyzed as a mora (Ussishkin, 2000). However, as section 2.1.2 argues, these forms can be analyzed using morpheme-specific markedness constraints along the lines proposed in Pater (2000) and Pater (to appear). Given that the goal of this work is to eliminate templatic inputs/stipulation in the derivation of NTM languages, this morpheme-specific markedness solution is given below instead of the analysis in terms of a floating mora.

14. These examples and the generalization drawn from them do not consider possible linearizations such as *nakital*, etc., where the affixal consonant is linearized in a position which avoids complex margins by adding an additional vowel. Such possible alternative linearizations are discussed in section 2.1.3 when the differential ranking of ALIGN-AFFIX constraints relative to ALIGN-ROOT is considered.

In summary, the assumed inputs to the IA derivational verbs are given below:

(29) Input to Root-Derived Verbs in IA for the RP Approach:

- (a) Form I/*faʕl*: $\sqrt{\text{ROOT}}$, /a/
- (b) Form II/*faʕʕal*: $\sqrt{\text{ROOT}}$, /a/, \emptyset_2
- (c) Form III/*faaʕal*: $\sqrt{\text{ROOT}}$, /a/, \emptyset_3
- (d) Form VII/*nfaʕal*: $\sqrt{\text{ROOT}}$, /a/, /n-/
- (e) Form VIII/*ftaʕal*: $\sqrt{\text{ROOT}}$, /a/, /-t-/
- (f) Form X/*staʕal*: $\sqrt{\text{ROOT}}$, /a/, /sta-/

These inputs are well-motivated from the standpoint of the Arabic derivational paradigm, and each of them have independently been proposed in the literature (McCarthy, 1981; McCarthy & Prince, 1990; Ussishkin, 2000), with the exception of the \emptyset morphemes in forms II/III, to be discussed below.

At first glance, these inputs might seem to run afoul of the fundamental claim of Optimality Theory of RICHNESS OF THE BASE (Prince & Smolensky, 1993/2004). The question which immediately arises in the context of the discussion below is what happens to inputs which come fully specified with vowels, such as a candidate *faʕal* for form I. In fact, the analysis below predicts that such an input, as long as it is not accompanied by further vocalic affixes, will surface faithfully. This is a welcome result from the perspective of morphophonology, since such a word is well formed, phonologically. However, this also means that the learner of Arabic needs some other evidence to arrive at positing a consonantal root. That evidence comes from the morphosyntactic alternation of such vocalic material. As Diesing & Jelinek (1995) note, vowels in Arabic carry the morphosyntactic burden of voice and aspect, meaning that alternations in these vowels across different aspects/voices will force the inclusion of vocalic material in the input. Once this input is considered, the consonantal root must be posited if Lexicon Optimization is to be maintained, as an input with vowels already specified would have a more unfaithful mapping to the surface output than an input with a purely consonantal root. With this understanding of the inputs in the IA verbal system in mind, the next sections turn to outlining the RP analysis in detail.

2.1.1. Form I: *faʕal/marr*

Beginning first with the biliteral roots, form I/*marr* shows doubling of the second consonant (gemination) and no fission of the input vowel. The attested form is more harmonic than output forms which epenthesize an unmarked vowel (*marr*), and those which fission the input vowel (*mara*).¹⁵

15. In what follows, candidates will not be considered which violate FTBIN, shown in section 1.2 to be the minimal prosodic word in IA. Thus, it is taken for granted that all

- (30) NONFIN(ALITY)(σ):
The head syllable of a prosodic word is not final in ω .
- (31) INT(EGRITY):
A segment in the output has a single correspondent in the input.¹⁶
- (32) MD:
A cover constraint for:
(a) MAX:
No deletion.
(b) DEP:
No epenthesis.

(30) is the member of the NON-FINALITY family of constraints introduced in section 1.1 to account for stress facts in IA. Whereas the constraint in that section focused on the head foot, this constraint concerns itself with the position of the head syllable with respect to the ω -final edge.¹⁷ The other two constraints are standard members of Correspondence Theory's faithfulness inventory, with MAX and DEP conflated since their distinction is not relevant to the present work. Ranking both the faithfulness constraints over NONFIN(σ) ensures that these outputs never surface, as Tableau 5 shows:

$\sqrt{\text{mr, /a/}}$	INT	MD	NONFIN(σ)
☞ a. [('marr)]			*
b. [('mari)]		*!	
c. [('mara)]	*!		

Tableau 5: INT, MD >> NONFIN(σ)

Another possible candidate which must be ruled out is *amr*, the candidate which attempts to satisfy the constraint CONTIGUITY, which prevents intrusion in the output. This constraint must be dominated by *COMPLEX, which rules out complex margins. This is in line with the generalization in the preceding section that complex margins in IA are only tolerated at the cost of linearizing other affixal material, which is not present in form I. The relevant ranking argument is in Tableau 6:

outputs must augment the input in some way, since CVC is subminimal. Also, not shown in what follows is a crucially dominated IDENT- μ constraint, which mitigates *against* moraic augmentation of the input. This constraint must be ranked very low in IA anyway, as the facts in this section, section 2.1.2, and the facts from broken plurals (McCarthy, 2000) demonstrate.

16. In this work we do not show or consider candidates which violate UNIFORMITY, the constraint which bans coalescence. For all practical purposes, uses of INTEGRITY in this work can be understood to mean both INTEGRITY and UNIFORMITY.

17. This distinction will henceforth be noted as NONFIN(σ) and NONFIN(F).

(33) *COMP(LEX): A cover constraint for:

(a) *COMPLEX^{ons}:

No complex onsets.

(b) *COMPLEX^{cod}:

No complex codas.

√mr, /a/	*COMPLEX	CONTIGUITY
☞ a. [(^l marr)]		*
b. [(^l amr)]	*!	
c. [(^l mra)]	*!	

Tableau 6: *COMPLEX >> CONTIGUITY

Finally, of the candidates which satisfy MAX/DEP, INTEGRITY, and *COMPLEX, several are viable. However, including a constraint which punishes metathesis of input material and the constraints on consonant moraicity as given in section 1.1 are enough to rule out these candidates. These constraints need not be ranked with respect to the undominated constraints in the two previous tableaux, as tableau 7:

(34) LIN(EARITY):

No metathesis.

√mr, /a/	*Comp	Int	MD	NonFin(F)	*App	*μ/C	Lin
☞ a. [(^l marr)]				*		*	
b. [(^l marr)]				*	*!		
c. [(^l ramm)]				*		*	*!

Tableau 7: No Ranking Needed

In this tableau, candidate (a) wins because it is the most harmonic. Among its interesting competitors, (b), or a candidate which attempts to lengthen the vowel instead does worse on the constraint *APPEND, since coda consonants must be moraic where possible. Notice that normally coda consonants are not moraic in this position in the language at large, as section 1.1 showed that NONFIN >> *APPEND. However, with the addition of the new constraints in Tableau 7, the only way in which a candidate can avoid violating NONFIN is to violate some other, more highly ranked, constraint, and thus moraic consonants are tolerated word-finally because of the inconsequence of NONFIN. Finally, even though (c) respects *APPEND, it metathesizes the input root material, to the consternation of LINEARITY.

We thus see in the analysis of form I with biliteral roots that all serious competitors must satisfy MD and LIN. Since these constraints are universally satisfied, they will not be shown unless candidates which violate them are

informative over and above the generalizations established for biliteral roots here.

Turning now to trilateral roots, one can see that the attested output form, *faʕal* shows fission with respect to the input vowel /a/. Normally, however, since INTEGRITY >> NONFIN(σ), pressures against being monosyllabic are not enough to force fission of the input vowel. What is different about trilateral roots is that any candidate which does not fission the input vowel will incur a *COMPLEX violation. Thus, as Tableau 8 shows, ranking *COMPLEX >> INT ensures the correct output.¹⁸

√ʕl, /a/	*COMPLEX	INT	NONFIN(σ)	CONTIGUITY
☞ a. [('faʕal)]		*		**
b. [('faʕl)]	*!		*	*
c. [('ffal)]	*!		*	*

Tableau 8: *COMPLEX >> INTEGRITY

Thus, while INTEGRITY is highly respected in biliterals, where complex margins are not an issue, the trilateral cases show that it is in fact *COMPLEX which is most highly valued in these forms.¹⁹ However, two troubling candidates remain unaccounted for. These candidates are *qʕʕal* and *faʕla*. These candidates both fission the input vowel, but do it in a way which respects CONTIGUITY more than the attested output, *faʕal*. The reason for the ungrammaticality of these candidates, we argue, is that they do not align the root material with the edge of the prosodic word. This can be formalized with the constraint in (35), and ranking it above CONTIGUITY ensures that such forms do not surface.²⁰

18. It is important for evaluating Tableau 7 that *COMPLEX be evaluated in terms of melodic material only. This is because geminates do not count as complex consonants in Arabic (cf., Watson, 2002).

19. A reviewer worries about how literal the violation of CONTIGUITY is for forms like these, given that the fission analysis assumes that there is only one segmental correlate of the vowel against which to reckon violations. Note that the way that CONTIGUITY violations are assessed in the text, this mark remains regardless of the number of extra vowels which result from fission. This is because as at least one of those vowels will correspond to the input segment, and this vowel will intrude on the root, resulting in a violation of CONTIGUITY.

20. A reviewer raises the question of how ALIGN-ROOT affects the tableaux which precede its introduction, especially Tableau 6, since the candidates ruled out by *COMPLEX in that tableau are also subject to violation marks from ALIGN-ROOT. This highlights the importance of interpreting ALIGN-ROOT the way it is stated in the text. Assigning violations per root consonant shows implies that *COMPLEX >> ALIGN-ROOT, as candidates like *amr* fully satisfy the former but not the latter.

(35) ALIGN-R(oo)T:

A cover constraint for:

(a) ALIGN-R(root, ω):

The right edge of every root is aligned to the right edge of some prosodic word. Assign one violation mark for each root segment not properly aligned.

(b) ALIGN-L(root, ω):

The left edge of every root is aligned to the left edge of some prosodic word. Assign one violation mark for each root segment not properly aligned.

√fʕl, /a/	ALIGN-RT	CONTIGUITY
a. [(^l fʕʕal)]		**
b. [(^l af)ʕal]	*!	*
c. [(^l fʕʕ)al]	*!	*

Tableau 9: ALIGN-RT >> CONTIG

Thus the RP approach produces the correct output for form I verbs, both with two- and three-consonant roots, by ensuring that no other linearization of input material is possible given the constraints at play, most of which are prosodic, in line with GTT. This result, furthermore, was reached without using any constraints not standardly assumed in the literature on Optimality Theory and GTT. The magic of NTM, therefore, is in constraint interaction – and nothing else. The final ranking arguments arrived at in this section are summarized in (36):

(36) Morphological Rankings for IA Thus Far:

(a) *COMP >> INT >> NONFIN(σ)

(b) MAX, DEP >> NONFIN(σ)

(c) *COMP >> CONTIG

(d) ALIGN-RT >> CONTIG

2.1.2. Forms II, III: The moraic forms

Turning now to forms II (*fʕʕʕal*) and III (*fʕʕʕal*), there are two problems for the analysis presented thus far. The first of these problems is one common to any analysis of Arabic (see, *e.g.*, Moore, 1990; Ussishkin, 2000, for discussion). The problem is how an analysis which treats forms II and III as differing from I only in the inclusion of an additional morpheme can successfully ensure that inputs to form II verbs do not surface as form III verbs, and vice-versa.

The initial solution to this problem presented in McCarthy (1979, 1981) is that form II and form III have different templates which are the base when the root morpheme associates to the CV-timing template. In form II, this association occurs from to a CVCCVC template, and a combination of delinking and spreading ensures that the medial root consonant geminates

instead of the vowel. In form III, by contrast, association is to a CVVCVC template, and the initial vowel spreads instead. It is not the intent of this paper to argue explicitly against this account, but notice that it derives the form II and form III differences from a lexical contrast (in template). If the lexicon happened to look differently for Arabic, forms II and III would as well. On the explanatory side, then, the analysis in McCarthy (1979, 1981) leaves some unanswered questions.

Moore (1990) solves this problem with recourse to the idea of a nuclear mora. In Moore's (1990) analysis, form II and III differ as to the presence of a nuclear mora, which may only link to vowel slots in the representation. Thus form II does not have a nuclear mora, and form III does. This analysis cannot be easily ported into the RP approach, not only because such autosegmental associations do not occur, but also because the RP approach attempts to do away with templatic information. The assumption of a floating mora in the input, consistent with the analysis of these patterns in Moore (1990), Ussishkin (2000) and others approximates such templatic information, and thus should be dispreferred under the assumptions of the RP approach.

The important thing to realize here is that each of these solutions is orthogonal to the major claims of the RP approach. The building of particular prosodic templates, nuclear versus consonantal morae, indexed morae (see Ussishkin, 2000: ch.5), and indexed markedness constraints (see below) are all compatible with the basic assumption that the root is real and that templatic shape is given by prosody. Thus one is perfectly justified in assuming a particular analysis of forms II and III, provided that the analysis assumes the existence of a consonantal root morpheme and not a CV-tier or prosodic skeleton. The solution this work will adopt is that these forms are differentiated by different input zero-allomorphs, \emptyset_2 and \emptyset_3 . While such covert morphology is to be avoided wherever possible, its inclusion allows for removal of prosodic material in the input which is in line with the general theoretical claims made in the RP approach. The idea is that the inclusion of such null morphology serves to key the derivation toward its ultimate goal of either a form II or III verb when included in derivations.

The other problem is more serious and specific to the RP approach, however. One can see that the alternation in syllabicity which obtains in the form *l/faʕal* pattern does not hold in forms II/III. In these forms, both biliteral and trilateral roots surface with the templatic shape CVCCVC (or CVVCVC). This is problematic on the account given in the previous section, since it was shown there that NONFIN(F) must be dominated by INTEGRITY. This is to force the lack of fission of the input vowel in biliteral *marr* verbs, as Tableau 10 shows:

$\sqrt{\text{mr, /a/}}$	INT	NONFIN(F)
☞ a. [(^l marr)]		*
b. [(^l marar)]	*!	

Tableau 10: Preventing Bisyllabicity in Form I Bilaterals

If this ranking is correct (as section 2.1.1 argues it is), then the wrong output for form II is predicted, as Tableau 11 shows:

$\sqrt{\text{mr, /a/}}$	INT	MAX	NONFIN(F)
☞ a. [(^l marr)]			*
⊗ b. [(^l mar)rar]	*!		*
c. [(^l mar)]		*!	*

Tableau 11: Incorrect Output for Biliteral Roots in Form II

One can see that since no threatening *COMPLEX violation exists to compel further violation of INTEGRITY, monosyllabic output is expected for biliteral roots. One can even go further to say that the only constraint which favors the attested output *marrar* over *marr* is NONFIN(F). From this it follows that NONFIN(F) >> INT, and a ranking contradiction results.

We would like to argue that a suitable solution exists to both these problems, and that is to treat forms II and III as systematic exceptions to the otherwise default templatic form. In treating these forms as exceptions, a solution becomes available within the class of approaches which admits the existence of markedness constraints relativized to particular classes of morphemes (Pater, 2000; Flack, 2007; Pater, 2009). As discussed in Pater (2009), MORPHEME-SPECIFIC MARKEDNESS CONSTRAINTS are a possible solution to such morpheme-specific exceptions and can be understood to arise only when RECURSIVE CONSTRAINT DEMOTION (Tesar & Smolensky, 2000) fails to achieve a satisfactory ranking.²¹ This is precisely the situation we are in with the ranking contradiction between NONFIN(F) and INTEGRITY. The morpheme-specific

21. See also Becker (2009) for discussion of limiting the application of “constraint cloning” to instances where Recursive Constraint Demotion fails to converge. While it is not the purpose of this work to evaluate the idea of constraint cloning, it does make sense to want to limit its application to only those contexts where no other solution presents itself to the language-learner. Note that the claim here is not that the Arabic child learns form II and III as idiosyncrasies to be listed in the lexicon. Rather, what this analysis suggests is that speakers treat forms I, VII, VIII, and IX on the one hand and II, III, V, and VI on the other as separate verbal paradigms. Within each paradigm, the prosodic restrictions are systematic, but the two paradigms must be learned separately. See also note 27 for more on the empirical motivations of this paradigmatic separation.

markedness constraint option, then, appears to be a reasonable formalization of a solution to this problem.²²

The solution to this problem in the Pater (to appear) approach is to define two different lexical classes corresponding to forms II and III. This already has partially been done with respect to the inputs with the indexing of \emptyset for particular patterns in Arabic. All that remains is to define a set of lexically-indexed markedness constraints which make reference to these two inputs. The following two will suffice:

- (37) $\text{NONFIN}(\text{F})_{2,3}$:
The head foot of an output containing a realization of a morpheme marked 2 or 3 is not final in ω .
- (38) $\text{NoLONGV}(\text{OWEL})_2$:
Outputs containing a realization of a morpheme marked 2 do not contain long vowels.²³

Since the informal idea in these forms is that the need for nonfinal stress outweighs the need to have monosyllabicity, it is clear that the class-specific prosodic markedness constraint $\text{NONFIN}(\text{F})_{2,3}$ must outrank $\text{DEP}-\mu$, the faithfulness constraint which penalizes moraic augmentation. This is not shown in tableaux which follow, as the general strategy of deriving templatic effects with no prosodic material in the input means that such constraints must be ranked quite low in NTM languages. Thus, the ranking $\text{NONFIN}(\text{F})_{2,3} \gg * \mu/\text{C}, \text{INT}$ is sufficient to ensure bisyllabicity in biliteral roots, as Tableau 12 shows:²⁴

22. One problem that has been noted with this framework is that it predicts the existence of the putatively unattested cases of templatic backcopying in reduplication contexts. While a proper discussion of reduplication would take this work too far afield, let me make two comments here. First, it is not entirely clear that templatic backcopying does not exist, as convincingly argued by Gouskova (2007). Second, even if backcopying does not exist, this will not be a problem in the otherwise templatic language of Arabic, as there is very limited reduplication in Iraqi Arabic (Erwin, 2004). Nevertheless, the tenability of the Pater (to appear) approach to idiosyncrasy with respect to templatic backcopying must remain a question for future research.

23. There is a symmetric solution to this problem which involves marking the constraint $* \mu/\text{C}_3$ and not marking NoLONGV . The choice between these two has no consequence, and so we assume the NoLONGV version here.

24. Note that these tableaux which follow do not consider candidates such as *mara*, where the root does not fission to fill a word-final consonant position, since these candidates will be sub-optimal from the perspective of ALIGN-RT , shown in the previous section to be undominated in IA.

$\sqrt{\text{mr, /a/}, \emptyset_2}$	NONFIN(F) _{2,3}	* μ /C	INT	DEP- μ
☞ a. [(^l mar)rar]		*	*	*
b. [(^l maar)]	*!			*

Tableau 12: NONFIN(F)_{2,3} >> * μ /C, INT

Thus the candidate (b), which attempts to avoid both fissioning the input vowel /a/ and having a moraic consonant, loses since this necessarily incurs a violation of NONFIN(F)_{2,3}. One can also see that NoLONGV₂ must dominate * μ /C, as Tableau 13 shows, preventing the derivation of form III in form II verbs:

$\sqrt{\text{mr, /a/}, \emptyset_2}$	NoLONGV ₂	* μ /C
☞ a. [(^l mar)rar]		*
b. [(^l maa)rar]	*!	

Tableau 13: NoLONGV₂ >> * μ /C

Thus candidate (b), the form III parse, loses because of the activity of NoLONGV₂. In this way, both the problems outlined above for the RP approach in form II/III verbs are solved by the inclusion of morpheme specific markedness constraints, thus providing an argument for their inclusion. Turning to trilateral verbs, the ranking just established carries over unaltered, as Tableau 14 shows:

$\sqrt{\text{fʔl, /a/}, \emptyset_2}$	NONFIN(F)	NoLONGV ₂	* μ /C
☞ a. [(^l faʔ)ʔal]			*
b. [(^l faa)ʔal]		*!	

Tableau 14: Form II verbs with trilateral roots

A similar argument using the ranking * μ /C >> NoLONGV, the general version of the constraint banning long vowels, can be adduced to analyze the form III/ *faaʔal* form. However, for reasons of space, explicit tableaux are omitted here, though they can be constructed easily from Tableau 14, *mutatis mutandis*.²⁵

Before leaving the topic of forms II and III, a final word concerning the analysis and its relation to previous analyses of these forms is worth making. In the works of McCarthy & Prince (1990), Moore (1990), and Ussishkin (2000),

25. A reviewer asks how this analysis is different from the one proposed in McCarthy (1979, 1981) based on the delinking of the third root consonant in form II verbs. The difference lies in the assumed input: the McCarthy (1979, 1981) analysis assumes the existence of two templates, CVCCVC for form II and CVVCVC in form III. In contrast, the RP approach derives the shape of these templates during the course of the derivation. The present approach does share with that in McCarthy (1979, 1981) the notion that the difference in pattern between forms II and III lies in the lexicon, however.

these forms are analyzed as differing from the *faʕal* form by the addition of a single mora in the input. This analysis does not differ from its predecessors in claiming that it is the notion of length which separates forms II and III from form I, it does differ in the way in which this length difference is cached out theoretically. Specifically, since the goal of the RP approach is to derive all templatic information, one could entertain the stronger claim in (39) concerning templatic information in the input:

(39) Inputs never contain prosodic material.

While it must be the topic of future research to evaluate the feasibility of a claim as strong as (39), maintaining it does not require abandoning the notion that what separates forms II/III from form I is length. Specifically, it was shown in Tableau 12 that syllable-final consonants are required to be moraic because of the activity of $\text{NonFin}(\text{F})_{2,3}$ and NoLongV_2 . Thus the RP approach can maintain this length-contrast-based analysis of forms II and III while eliminating the need for prosodic material in the input, as long as one is prepared to meet the challenge of prosodic augmentation with indexed markedness constraints. The approach advanced here amounts to claiming that instead of there being a subset of derived verbs which are formed in IA by prosodic augmentation, IA instead possesses two distinct prosodic paradigms into which verbs are classified, with each paradigm possessing its own notion of optimal prosodic form.²⁶ Thus, the RP approach shows that allowing indexed markedness constraints over prosodic form allows for the elimination of prosodic material in the input, a strict interpretation of the aims of Generalized Template Theory.²⁷ With this analysis in hand, the next section focuses on those forms which differ from the form *I/faʕal* pattern by simple affixation.

26. Draga Zec deserves thanks for this observation. While this may seem like an *ad hoc* division based upon the discussion in the present work, there is actually some support for it in terms of which verbal patterns form active/passive pairs in Arabic (and Semitic more generally). See Arad (2003, 2005), and Tucker (In Press) for more discussion.

27. A weak prediction of the RP approach using indexed markedness constraints is that a particular NTM language should only be able to select from a subset of logically possible prosodic paradigmatic alternations, with the selection space constrained by the language-wide ranking of other markedness constraints. In the case of IA, one would never expect a template of the form CVCCVC, given that *COMPLEX is independently shown to be ranked high. An interesting question which must be left for further research is whether or not there is a limit to the amount of prosodic variation one language allows across paradigms, in line with this prediction.

2.1.3. Forms VII, VIII, X: pure prefixing/infixing

Turning now to other verbal forms in Iraqi Arabic, one can identify a class of verbs which differ from form I only in the addition of extra prefixal/suffixal material. These verbs are repeated from above in Table 3.

	Triliteral	Biliteral
Root	√fʕl	√mr
VII	nfaʕal	nmarr
VIII	ftaʕal	mtarr
X	staʕal	stamarr

Table 3: Pure Prefixing/Infixing Forms in IA

In each case, one can analyze these forms as a form I base plus some affixal material (though see below for discussion of form X). This can be formally captured by defining constraints of the Generalized Alignment family which position each affix in linear prosodic structure. For ease of exposition, this work assumes that there are two classes of such affixes, and simply defines two placeholder constraints over these groups:²⁸

1. *Prefix*₁: /n/, /t/ (in forms V and VI), /st/
2. *Prefix*₂: /t/ (in form VIII)

28. In this analysis we draw a distinction between the /t/ affix in forms V, VI and the /t/ affix in form VIII. A reviewer correctly points out that this is not a trivial assumption, as previous work (McCarthy, 1979, 1981; Moore, 1990; McCarthy & Prince, 1993) has claimed that these are differential linearizations of the same mediopassive infix (-)t-.

The evidence for treating the *t*'s as the same prefix derives mainly from the semantic overlap in these forms, as well as the affixal homophony (McCarthy, 1979). However, there is both phonological and semantic evidence that suggests that this conflation comes at a cost: the form VIII -t- undergoes the semivowel allomorphy discussed in McCarthy (1979, 1981) and Tucker (2010), whereas the forms V and VI *t*- does not. Moreover, as Younes (2000) discusses, there semantic generalization of “mediopassive” for form VIII is less motivated than it is for forms V and VI in spoken Arabic dialects, as form VIII verbs tend to be highly lexicalized in meaning. Thus, there is distributional evidence to doubt a unified treatment of forms VIII and V/VI (*cf.*, Ussishkin, 2000: ch.5 for another such view).

Finally, it is worth pointing out that one could still entertain an analysis which treats the forms V, VI and VIII (-)t- as the same affix, if one assumes that phonological content is formally separated from morphosyntactic featural content, as in the framework of Distributed Morphology (Halle & Marantz, 1993, 1994, *et seq.*). In this approach, morphemes, formally, are terminal feature bundles in the syntax, whereas exponents or Vocabulary Items are the phonological expression of morphemes. This approach would then take the classes *prefix*₁ and *prefix*₂ from the text to be syntactically defined — the morphological component would then insert the same Vocabulary Item in both cases. This would account for the morphological and semantic idiosyncrasies of form VIII relative to V and VI, as well as preserve the reviewer's suggestion. See Tucker (in press) for one implementation of this approach.

Beginning with the forms which show members of the class of *prefix*₁, the relevant alignment constraint is as in (40):

- (40) ALIGN-L(*prefix*₁, ω) (ALIGN-*pre*₁):
Align the left edge of affixes belonging to the class *prefix*₁ to the left edge of some prosodic word.

The relevant ranking for this constraint is given in Tableau 15:

/fʕl/, /a/, /n/	ALIGN- <i>pre</i> ₁	Align-RtL	*COMPLEX ^{ONS}
☞ a. [('nfafʕal)]		*	*
b. [('nafʕal)]		**!	
c. [('fnaʕal)]	*!		*

Tableau 15: ALIGN-*pre*₁ ALIGN-RtL *COMPLEX^{ONS}

Thus, informally, in form VII it is more important to linearize the input prefix to the left edge of the prosodic word than it is to keep the root aligned there (because (c) loses). Additionally, this violation of ALIGN-RtL must be minimal, even at the cost of a *COMPLEX violation. This analysis is also in accord with the generalization about the distribution of complex margins given above.

For output forms containing members of the class *prefix*₂ (form VIII in IA), this relevant ranking between ALIGN-RtL and the affixal alignment constraint is reversed. The relevant constraint is as in (41) and the ranking argument given in Tableau 16.

- (41) ALIGN-L(*prefix*₂, ω) (ALIGN-*pre*₂):
Align the left edge of affixes belonging to the class *prefix*₂ to the left edge of some prosodic word.

/fʕl/, /a/, /t/	Align-RtL	ALIGN- <i>pre</i> ₂	*COMPLEX ^{ONS}
☞ a. [('ftafʕal)]		*	*
b. [('fatʕal)]		**!	
c. [('tfaʕal)]	*!		*

Tableau 16: ALIGN-RtL >> ALIGN-*pre*₂ >> *COMPLEX^{ONS}

Thus in these forms, unlike in the forms containing *prefix*₁ elements, it is more important to linearize the root at the left edge of ω than it is to keep the infix there. This is thus an output-optimizing formulation of McCarthy's (1981) Eighth Binyan "flop." Candidate (c), which fails to perform this "flop" loses because of the high-ranking ALIGN-RtL. Violation of ALIGN-*pre*₂ must be minimal, however, as the failure of candidate (b) shows.

For the roots containing two consonants, the arguments above carry over, *mutatis mutandis*. Since INTEGRITY NONFIN(σ), as shown in the previous section, the RP approach expects nothing to change with biliteral roots in these

forms. The only difference expected is the edge-aligned inclusion of the affixal material, which is exactly what is attested for biliteral roots in these forms.

Stepping back from the details of this analysis for a moment, one can see that a prediction of the RP analysis and the ranking $*\text{COMPLEX} \gg \text{INTEGRITY} \gg \text{NonFin}(\sigma)$ (established in section 2.1.1). This prediction is that where $*\text{COMPLEX}$ does not dictate otherwise, fission of the input /a/ should not occur. This is impossible when the only input material is a consonantal root and single vowel (for trilaterals). However, when the input material contains a vowel (in addition to the aspectual vowel seen thus far), and there is a potential linearization of this input material which utilizes this vowel to avoid a $*\text{COMPLEX}$ violation, this candidate should win. This is *exactly* what happens in the form $X/\text{staf}^\text{f}al$ pattern with trilaterals, as Tableau 17 shows.

/fʕl/, /a/, /sta/	ALIGN- <i>pre</i> ₁	ALIGN-RtL	$*\text{COMPLEX}^{\text{ons}}$	INT
a. [ʕʰstafʕal]		*	*	
b. [ʕʰfasʰ(taʕl)]	*!		*	
c. [ʕʰstafaʕʕal]		*	*	*!

Tableau 17: Extensions to Form $X/\text{staf}^\text{f}al$

Thus, the fact that this form is not attested as $*\text{stafafal}$ is a further confirmation of the RP approach and its specific claims about the centrality of NonFinality to word-formation in Arabic. Generalizing from the arguments in this section, one can add the following ranking arguments to those at the end of the previous section:

- (42) Further Ranking Arguments:
 ALIGN-*pre*₁ \gg ALIGN-RtL \gg ALIGN-*pre*₂ \gg $*\text{COMPLEX}^{\text{ons}}$

Excursus: form VIII-specific phonology

The assumption central to the RP approach that the root is a morpheme in the input also provides this model with the means to explain a set of particularly recalcitrant facts in the phonology of the form VIII/ $\text{fta}^\text{f}al$ pattern first noticed in McCarthy (1979). Specifically, form VIII shows alternations in voicing and continuancy which are not reflected in the language at large:

- (43) Progressive Voicing Assimilation in Form VIII (Erwin, 2004):
 (a) ddiʕa, ‘to claim’ ($*\text{dti}^\text{f}a$; $\sqrt{\text{d}^\text{f}w}$)
 (b) zdiʕam, ‘to be crowded’ ($*\text{zti}^\text{f}am$; $\sqrt{\text{z}^\text{f}m}$)

Assuming that emphasis is represented phonologically as [+RTR] (Davis, 1995), these facts can be captured straightforwardly in the RP approach. All that is needed are the following three constraints:

- (44) FAITH:
Corresponding segments have identical feature specifications.
- (45) AGREE-Voi(CE):
cover constraint for AGREE([voice]) and AGREE([RTR]):
Any two adjacent obstruents must have identical specifications for [voice] and [RTR].
- (46) FAITH-R(oot):
Corresponding segments in the root have identical feature specifications.

(44) is a general constraint standing for the unification of all the constraints belonging to the familiar IDENT family, irrespective of morphological affiliation. AGREE-Voi stands in as a placeholder constraint for any markedness constraint sufficiently defined to trigger such assimilation. The interesting constraint in the RP approach is the constraint in (46), FAITH-RT, as this constraint cannot be defined as it is above in frameworks which do not admit the existence of the consonantal root. Because FAITH is here relativized to the root consonants given in the input, the RP approach provides a formal means of distinguishing root consonants from other consonants in the output. This constraint is crucial to the RP analysis of these forms (though it need not be ranked), as Tableau 18 demonstrates:

$\sqrt{d^c}rb, /a/, /t/$	AGREE-Voi	FAITH	FAITH-RT
☞ a. $d^s d^s arab$		*	
b. $tt arab$		*	*!
c. $d^s tarab$	*		

Tableau 18: AGREE >> Voi FAITH

Notice that the inclusion of FAITH-RT in Tableau 18 ensures that faithfulness to the root triggers a reversal of the language-at-large strategy for resolving voice mismatches. In any framework which does not admit the existence of the consonantal root, and therefore treats all output consonants the same predicts that voicing assimilation in this pattern should be regressive (the directionality of assimilation in the language at large). This candidate (b) should then surface, contrary to fact.

A similar problem arises for word-based approaches in form VIII when the first member of the root is a semivowel (or /ʔ/). In these patterns, semivowels surface as doubling of the input infix, /-t-/ (and such assimilation does not occur in the language at large):

- (47) Weak Consonants in Iraqi Arabic (Erwin, 2004):
- (a) $ttid3ah$, ‘to head (for)’ ($\sqrt{wd}3h$, $*utid3ah$, $*wtid3ah$)
 - (b) $ttiqaṇ$, ‘to master, know well’ ($\sqrt{ʔqn}$, $*itiqaṇ$, $*jtiqaṇ$)
 - (c) $ttixaḍ$, ‘to take, adopt’ ($\sqrt{ʔxḍ}$, $*ʔtixaḍ$)

At first, such data might seem problematic for the RP approach, as (47) appears to be an instance of excessive unfaithfulness to roots. However, having FAITH-RT as an available constraint means that it can be dominated, and excessive unfaithfulness to roots is expected, under limited circumstances. Note, too, that this option is not available for an approach which denies the existence of the consonantal root and therefore cannot separate root instances of semivowels from their non-assimilating, nonroot counterparts without also predicting that they should undergo regressive voicing assimilation, contrary to fact. In order to formalize this alternation in the RP approach, let us assume the following constraints:

- (48) S(ONORITY) S(EQUENCING) P(RINCIPLE):
Sonority does not fall from onset to nucleus; Sonority does not rise from nucleus to coda.
- (49) *WW(/ONSET):
Geminate glides are forbidden in onset position.

(48) is a simple Optimality-Theoretic version of the Sonority Sequencing Principle, which bans adjacent elements whose sonority curve is a reversal (Hankamer and Aissen, 1974). (49) is a markedness constraint which bans onset geminate liquids at any level of representation. This constraint *WW must be ranked above FAITH-RT, as Tableau 19 demonstrates:

$\sqrt{ws}^{\circ}l, /a/, /t/$	*WW	FAITH-RT
☞ a. ttas [◦] al		*
b. ww [◦] as [◦] al	*!	

Tableau 19: *WW >> FAITH-RT

Notice that this ranking yields the observed unfaithfulness to root segments, but only in the case of avoiding a geminate liquid sequence. As to the rest of the analysis of this assimilation, Tableau 20 provides the relevant rankings:

$\sqrt{ws}^{\circ}l, /a/, /t/$	SSP	ALIGN-RT	FAITH	FAITH-RT
☞ a. ttas [◦] al			*	*
b. tw [◦] as [◦] al		*!		
c. ?utas [◦] al		*!		
d. wt [◦] as [◦] al	*!			

Tableau 20: SSP, ALIGN-RT >> FAITH, FAITH-RT

Thus the final rankings added to the grammar of IA in this excursus are:

(50) Rankings for assimilation in Form VIII:

- (a) AGREE-VOI >> FAITH
- (b) *WW >> FAITH-RT
- (c) ALIGN-RT, SSP >> FAITH, FAITH-RT

In analyzing these assimilation facts as either crucial domination by or crucial domination of FAITH-RT allows the RP approach to provide a unified explanation of these facts in terms of the consonantal root. This is a particularly appealing result because the key generalization at play in these alternations is that the phonology has special access to consonants *qua* root consonants in these forms. This generalization is thus captured under the RP approach, and provides a reason to prefer it.

With this solution in place, the RP approach can successfully account for the two- and three-consonant roots in all their derivational patterns in Iraqi Arabic. The last section of the analysis turns to sketching out some of the theoretical implications of the RP approach advanced here.

2.2. Theoretical implications

Several theoretical implications follow neatly from the assumptions of the Root-and-Prosody Approach which are useful to work outside of NTM languages. The first of these is an explanation for a previously noticed fact concerning the templatic shape of words in Arabic. It has commonly been noted that default prosodic form in Arabic and Hebrew displays an apparent anti-tendency, to borrow a term from Clements (1997). Specifically, templates in such languages consistently end in a consonant, with the default prosodic word in Arabic, for instance, being CVCVC. This is particularly surprising from the perspective of syllable markedness, which notes that CV syllables (*i.e.*, those without codas) are the least marked. Thus, McCarthy & Prince (1994) express this formally as the ad-hoc constraint in (51):

- (51) FINAL-C:
A prosodic word must end in a consonant.

This constraint is not only *prima facie* stipulative, but also undesirable from a markedness point of view, given that one would, all else being equal, prefer to have markedness constraints which ban marked, not unmarked, structures (Clements, 1997). The approach here does not need such a constraint, however, as it has instead the family of constraints ALIGN-ROOT (see section 2.1.1 for exemplification of this point), which dictate that the root must be aligned to both the left and the right edge of the prosodic word. These constraints do away with the need for (51), and moreover, explain why Semitic templates typically have such a consonant-final form – the root must be anchored to the

right edge of the prosodic word, and this is a highly-valued constraint in these languages.

Next, the RP approach also explains and does away with a mechanism of TIER CONFLATION, as proposed in McCarthy (1981), *et seq.* This process takes different autosegmental tiers and linearizes them with respect to one another, creating a pronounceable output string. Such a process is strange from the point of view of more concatenative languages, where it is not needed, and thus any theory which does away with it is desirable from the standpoint of GTT. RP is such a theory, since it claims that prosodic constraints drive Tier Conflation. Thus, no such mechanism is needed.

Additionally, the RP approach has no need to assume that any form in the derivational verbal system of IA is asymmetrically derived from any other. This is particularly useful since, as discussed in Marantz (1997), this assumption is made in the Fixed-Prosodic literature. These works relate the derivational verbs to a form *l/fafal* base, but not all such putative form I bases exist as independently attested output forms. In the RP approach, the existence of the root *qua* morpheme allows any suitable theory of selectional restrictions to avoid predicting such troubling unattested bases.

Finally, a further pleasant implication of the RP approach is an understanding of what it is, precisely, that makes an NTM language. NTM languages are, from a typological perspective, quite rare, and RP explains why this is. Specifically, the RP approach requires that a class of morphological and prosodic markedness constraints, MP-MARKEDNESS, outrank CONTIGUITY for an NTM to result. This is schematized in (52):

- (52) Ranking for NTM in the RP Approach:
MP-MARKEDNESS >> CONTIGUITY

This is a welcome result because it is able to relate the morphologies in languages which have NTM to the morphologies of more concatenative languages by simple constraint reranking, the source of all variation in Optimality Theory. This means that, unlike earlier approaches which couched the difference between NTM and, *e.g.*, English in the very generative engine itself (McCarthy, 1981), in the RP approach, Arabic, Hebrew, and the like are not substantially different from languages with purely concatenative morphologies. All that is different is the ranking of CONTIGUITY with respect to MP-MARKEDNESS.

3. Conclusions

This work has outlined a novel approach to the morphophonology of Arabic verbs called the Root-and-Prosody model, arguing it to be superior to other GTT-responsible models with respect to Iraqi Arabic. This approach also has argued for the necessity of the consonantal root *qua* morpheme and the

undesirability of the template. In examining the properties of the RP approach, a careful understanding of the Iraqi Arabic verbal system was given, the first of its kind in the generative phonological literature.

One important prediction of the RP approach is that roots and vocalic affixes are real units of NTM languages, whereas templatic form is rather emergent given particular inputs and prosodic constraints. While psycholinguistic data on the affixal status of vocalic material is more mixed (see, *e.g.*, Berent *et al.*, 2007), in a large way the RP approach brings the phonological understanding of NTM languages in line with present understanding in psycholinguistic and experimental research (*e.g.*, Frost *et al.*, 1997; Deutsch *et al.*, 1998; Boudelaa & Marslen-Wilson, 2004a, 2004b; Boudelaa *et al.*, 2009). This view is able to emerge because the RP approach takes discontinuous linearization of root and affixal material to be governed entirely by independently needed constraints on prosodic form. An interesting prediction of this approach is that it becomes impossible, *a priori*, to derive a nonconcatenative templatic morphology without high-ranking prosodic constraints that are demonstrably active elsewhere in the language at large. To the author's knowledge, this prediction is borne out for every NTM language studied to date.

In the future, research will be needed to delimit the space of applicability of the RP approach – here it is claimed that this approach is applicable to all root-derived words in NTM languages everywhere, but further work is needed to ensure this is the case for languages such as Hebrew, Maltese, Coptic, and Akkadian. However, to the extent that this work has proved successful, morphophonology now can more clearly ask the question: what is the root, and how do NTM languages make use of it?

REFERENCES

- ARAD, Maya (2003). Locality constraints on the interpretation of roots: The case of Hebrew denominal verbs. *Natural Language & Linguistic Theory* 21: 737-778.
- ARAD, Maya (2005). *Roots and Patterns: Hebrew Morpho-syntax*. Dordrecht: Springer.
- BAT-EL, Outi (1994). Stem modification and cluster transfer in Modern Hebrew. *Natural Language & Linguistic Theory* 12: 571-596.
- BAT-EL, Outi (2002). True truncation in colloquial Hebrew imperatives. *Language* 78: 651-683.
- BAT-EL, Outi (2003). Anti-faithfulness: An inherent morphological property. In Lecarme, J. (ed.), *Research in Afroasiatic Grammar II: Selected Papers from the Fifth Conference on Afroasiatic Languages*: 21-34. Philadelphia: John Benjamins.
- BECKER, Michael (2009). *Phonological Trends in the Lexicon: The Role of Constraints*. Doctoral Dissertation, University of Massachusetts, Amherst.
- BENUA, Laura (2000). *Phonological Relations between Words*. New York: Garland.
- BERENT, Iris; VERED, Vaknin; MARCUS, Gary F. (2007). Roots, stems, and the universality of lexical representations: Evidence from Hebrew. *Cognition* 104: 254-286.

- BOUDELA, Sami; MARSLEN-WILSON, William D. (2004a). Allomorphic variation in Arabic: Implications for lexical processing and representation. *Brain and Language* 90: 106-116.
- BOUDELA, Sami; MARSLEN-WILSON, William D. (2004b). Abstract morphemes and lexical representation: The CV-skeleton in Arabic. *Cognition* 92: 271-303.
- BOUDELA, Sami; PULVERMÜLLER, Friedemann; HAUKE, Olaf; SHYTYROV, Yury; MARSLEN-WILSON, William D. (2009). Arabic morphology in the neural language system. *Journal of Cognitive Neuroscience*: 1-13.
- BUCKLEY, Eugene (2003). Emergent vowels in Tigrinya templates. In Lecarme, J. (ed.), *Research in Afroasiatic Grammar II: Selected Papers from the Fifth Conference on Afroasiatic Languages*: 105-125. Amsterdam: John Benjamins.
- CHOMSKY, Noam (1955). *The Morphophonemics of Modern Hebrew*. Master's Thesis: University of Pennsylvania.
- CLEMENTS, G. Nick (1997). Berber syllabification: derivations or constraints? In Roca, I. (ed.), *Derivations and Constraints in Phonology*: 289-330. Oxford: Oxford University Press.
- DAVIS, Stuart (1995). Emphasis in grounded phonology. *Linguistic Inquiry* 26: 465-498.
- DEUTSCH, Avital; FROST, Ram; FORSTER, Kenneth I. (1998). Verbs and nouns are organized and accessed differently in the mental lexicon: evidence from Hebrew. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 24: 1238-1254.
- DIESING, Molly; JELINEK, Eloise (1995). Distributing arguments. *Natural Language Semantics* 3: 123-76.
- ERWIN, William M. (2004). *A Short Reference Grammar of Iraqi Arabic*. Washington, DC: Georgetown University Press.
- FLACK, Kathryn (2007). Templatic morphology and indexed markedness constraints. *Linguistic Inquiry* 38: 749-758.
- FROST, Ram; FORSTER, Kenneth I.; DEUTSCH, Avital (1997). What can we learn from the morphology of Hebrew? A masked-priming investigation of morphological representation. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 23: 829-856.
- GOLDSMITH, John A (1976). *Autosegmental phonology*. Bloomington: Indiana University Linguistics Club.
- GOUSKOVA, Maria (2007). The reduplicative template in Tonkawa. *Phonology* 24: 367-396.
- HALLE, Morris; MARANTZ, Alec (1993). Distributed morphology and the pieces of inflection. In Hale, K. & Keyser, S.J. (eds.), *The View from Building 20: Essays in Honor of Sylvain Bromberger*: 111-176. Cambridge, MA: MIT Press.
- HALLE, Morris; MARANTZ, Alec (1994). Some key features of distributed morphology. In Carnie, A. & Harley, H. (eds.), *Papers on Phonology and Morphology* 21: 275-288. Cambridge, MA: MIT Press.
- HANKAMER, Jorge; AISEN, Judith (1974). The sonority hierarchy. *CLS 10: Parasession on Natural Phonology*: 131-145.
- ITÔ, Junko; KITAGAWA, Yoshihisa; MESTER, Armin (1996). Prosodic faithfulness and correspondence: Evidence from a Japanese argot. *Journal of East Asian Linguistics* 5: 217-294.
- KRAMER, Ruth (2007). Nonconcatenative morphology in Coptic. In Kaplan, A. & Teeple, D. (ed.), *Phonology at Santa Cruz 7*. Santa Cruz, CA: In Research Center.
- MARANTZ, Alec (1997). *Words*. Ms., Massachusetts Institute of Technology.

- MCCARTHY, John J. (1979). *Formal Problems in Semitic Phonology and Morphology*. Doctoral Dissertation, Massachusetts Institute of Technology.
- MCCARTHY, John J. (1981). A prosodic theory of nonconcatenative morphology. *Linguistic Inquiry* 12: 373-418.
- MCCARTHY, John J. (1985). *Formal Problems in Semitic Phonology and Morphology*. New York: Garland.
- MCCARTHY, John J. (1993). Template form in prosodic morphology. *Papers from the Third Annual Formal Linguistics Society of Midamerica Conference*: 187-218.
- MCCARTHY, John J. (2000). Faithfulness and prosodic circumscription. In Dekkers, J.; van der Leeuw, F.; van de Weijer, J. (eds.), *Optimality Theory: Syntax, Phonology, and Acquisition*: 151-189. Oxford: Oxford University Press.
- MCCARTHY, John J. (2005). Optimal paradigms. In Downing, L.; Hall, T.A. & Raffelsiefen, R., *Paradigms in Phonological Theory*: 170-210. Oxford: Oxford University Press.
- MCCARTHY, John J.; PRINCE, Alan (1990). Prosodic morphology and Templatic Morphology. In McCarthy, J. & Eid, M. (eds.), *Perspectives on Arabic Linguistics II*: 1-54. Amsterdam: John Benjamins.
- MCCARTHY, John J.; PRINCE, Alan (1993). Generalized Alignment. *Yearbook of Morphology*: 79-153.
- MCCARTHY, John J.; PRINCE, Alan (1993a). Prosodic Morphology I. Technical Report #32. New Brunswick, NJ: Rutgers University Center for Cognitive Science. Available at: http://works.bepress.com/john_j_mccarthy/54.
- MCCARTHY, John J.; PRINCE, Alan (1994). The emergence of the unmarked: Optimality in prosodic morphology. In *Proceedings of NELS 24*: 333-379.
- MCCARTHY, John J.; PRINCE, Alan (1995). Faithfulness and reduplicative identity. *University of Massachusetts Occasional Papers in Linguistics* 18: 249-384.
- MOORE, John (1990). Doubled verbs in Modern Standard Arabic. In McCarthy, J. & Eid, M. (eds.), *Perspectives on Arabic Linguistics II*: 55-93. Philadelphia: John Benjamins.
- NEVINS, Andrew I. (2005). Overwriting does not optimize in nonconcatenative morphology. *Linguistic Inquiry* 36: 275-287.
- PATER, Joe (2000). Non-uniformity in English secondary stress: The role of ranked and lexically specific constraints. *Phonology* 17: 237-274.
- PATER, Joe (2009). Morpheme-specific phonology: Constraint indexation and inconsistency resolution. In Parker, S. (ed.), *Phonological Argumentation: Essays on Evidence and Motivation*: 123-154. London: Equinox.
- PATER, Joe (to appear). Morpheme-specific phonology: Constraint indexation and inconsistency resolution. In Steve Parker (ed.), *Phonological argumentation: Essays on evidence and motivation*. London: Equinox.
- PRINCE, Alan; SMOLENSKY, Paul (1993/2004). *Optimality Theory: constraint interaction in Generative Grammar*. Oxford: Blackwell.
- ROSENTHALL, Sam; VAN DER HULST, Harry (1999). Weight-by-position by position. *Natural Language & Linguistic Theory* 17: 499-540.
- RYDING, Karin C. (2005). *A Reference Grammar of Modern Standard Arabic*. Cambridge: Cambridge University Press.
- SHERER, Tim D. (1994). *Prosodic phonotactics*. Doctoral Dissertation, University of Massachusetts, Amherst.
- TESAR, Bruce; SMOLENSKY, Paul (2000). *Learnability in Optimality Theory*. Cambridge: MIT Press.

- TUCKER, Matthew A. (2010). Iraqi Arabic verbs: The need for roots and prosody. In Byram, Mary (ed.), *Proceedings of the 28th West Coast Conference on Formal Linguistics*. Somerville, MA: Cascadilla Proceedings Project.
- TUCKER, Matthew A. (In Press). The morphosyntax of the Arabic verb. In Fera, N.; Hankamer, J.; Thompson, A.; & Tucker, M. A. (eds.), *Morphology at Santa Cruz*. Santa Cruz, CA: Linguistics Research Center.
- USSISHKIN, Adam (1999). The inadequacy of the consonantal root: Modern Hebrew denominal verbs and output-output correspondence. *Phonology* 16: 401-442.
- USSISHKIN, Adam (2000). *The Emergence of Fixed Prosody*. Doctoral Dissertation. Santa Cruz, University of California.
- USSISHKIN, Adam (2005). A Fixed Prosodic Theory of Nonconcatenative Templatic Morphology. *Natural Language & Linguistic Theory* 23: 169-218.
- WATSON, Janet C.E. (2002). *The Phonology and Morphology of Arabic*. Oxford: Oxford University Press.
- YOUNES, Munther (2000). Redundancy and productivity in Palestinian Arabic verb derivation. In Mifsud, M. (ed.), *Proceedings of the Third International Conference of AiDA*: 27-32. Malta: Salesian Press.

RÉSUMÉ

De récentes études en morphologie non-concaténative et gabaritique, dans le cadre de la Théorie de l'Optimalité, tels les systèmes verbaux de l'arabe et de l'hébreu, soutiennent que ce type de morphologie peut faire l'économie de la racine consonantique (Bat-El, 1994; Ussishkin, 1999, 2000, 2005; Buckley, 2003). Cet article propose une approche qui concilie racine consonantique et gabarit prosodique. Inspirée d'un travail de Kramer (2007), cette approche soutient que les propriétés liées traditionnellement à racine-et-schème («Root-and-Pattern») découlent de la satisfaction des contraintes de marque prosodiques, au détriment des contraintes de fidélité, notamment CONTIGÜITÉ et INTÉGRITÉ. L'article montre en outre que les problèmes posés par les langues à morphologie non-concaténative et gabaritique trouvent des solutions dans le cadre de la Théorie du Gabarit Généralisé («Generalized Template Theory», McCarthy & Prince, 1995) où l'économie est faite des correspondances Output-Output. Ce faisant, il argumente pour l'extension des contraintes de marque indexées («indexed markedness constraint», Pater, à paraître) aux alternances prosodiques. En particulier, il est montré que l'augmentation prosodique résulte des hiérarchisations spécifiques de ces contraintes, évitant ainsi le recours au matériel prosodique dans l'*input*.

MOTS-CLÉS

Morphophonologie, morphologie gabaritique, racine consonantique, arabe.